4 AUDIO MODULE

4.1 Objectives

4.1.1 Understand and explain the nature of sound and how it is captured in a recording.

4.1.2 Understand and explain the various instruments used in analyzing sound.

4.1.3 Understand and explain the two categories of noise and how they relate to sound analysis.

4.1.4 Understand and explain the three types of distortion encountered in audio signals

4.1.5 Understand and explain the operation of voice recorders

4.1.6 Understand and explain the most common limitations of analog playback (distortion, speed errors, wow/flutter, noise floor, bandwidth, cross talk etc).

4.1.7 Understand and explain the most common limitations of digital recordings

4.1.8 Gain the capability to recognize the various tape formats and know their associated speeds.

4.1.9 Understand and explain the advantage of digital tape recorders over analog.

4.1.10 Understand and explain the various signal processing filters and how they are used in forensic audio analysis.

4.1.11 Gain and demonstrate the capability to use audio clarification hardware and software.

4.1.12 Gain the capability to do routine maintenance of audio clarification systems.

4.2 Methods of Instruction

4.2.1 Lectures

4.2.1.1 PCAP clarification system and its uses/operations

4.2.1.2 Cardinal clarification and its uses/operations

4.2.1.3 Pro Tools and its operation

4.2.1.4 Tape formats Noise

4.2.1.5 Digital vs. Analog recordings

4.2.2 Literature Review

4.2.2.1 Equipment and software Users Manuals

4.2.2.2 Department of Forensic Science, Digital Evidence Procedure Manual – audio sections

4.2.2.3 Other publications as they become available

4.2.3 Training Programs

4.2.3.1 Signalscape video and audio – Proficient operation of software as it pertains to forensic audio analysis.

4.2.3.2 Avid video and audio – Proficient operation of software as it pertains to forensic audio analysis

4.2.3.3 Basic two day course offered by the Signalscape vendor

4.2.3.4 Basic three day course offered by AVID/Ocean Systems vendor

4.2.3.5 PCAP- Proficient operation of the hardware and software

4.2.3.6 Basic audio course offered by Digital Audio Corporation vendor

4.2.3.7 Cardinal- Proficient operation of the hardware and software

4.2.3.8 Advanced audio course offered by Digital Audio Corporation vendor (preferred)

4.2.3.9 Pro Tools- Proficient operation of software.

4.2.3.10 M-box- Proficient operation of hardware.

4.2.4 Demonstration

4.2.4.1 Basic clarification techniques will be observed from beginning to end of mock cases as well as actual cases under the direct supervision of the Section Supervisor. These techniques will be observed for understanding and the ability to put the acquired knowledge into practical use. This will include proper case documentation and case notes.

4.2.5 Laboratory Exercises

4.2.5.1 Recording Equipment

4.2.5.2 Microphone vs. pickup for telephone recordings

4.2.5.3 Cell phone vs. landline phone clarification

4.2.5.4 PCAP training recordings

4.2.5.5 Casework will be completed by the trainee under the direct supervision of the Section Supervisor- content and techniques used will be dependent on the cases submitted.

4.3 Evaluation

4.3.1 Oral/ Written examination

4.3.1.1 Oral review on each technique and procedure utilized in this section.

4.3.1.2 Written paper(s) on related topic to be assigned and approved by the section supervisor. This will be considered a technical research paper.

4.3.1.3 Various techniques and terms to be defined both orally and written.

4.3.2 Laboratory Testing

- Trainee must complete as least 1 year of casework under the direct supervision of the Section Supervisor. This will include mock and actual cases.

4.3.3 Oral Exercises

- Technical review sessions. The trainee MUST successfully complete this portion of the requirements.

4.3.4 Courtroom Exercises

- Trainee will be required to work a case that is representative of actual casework. Trainee must be capable defending conclusions and answering questions in an actual courtroom scenario. The trainee MUST successfully complete this portion of the requirements.

4.4 Examination Questions

4.4.1 Explain how audio recording are produced.

4.4.2 What are the two categories of noise and what are the properties of each? Give an example of each.

4.4.3 Name three types of distortion encountered in audio signals.

4.4.4. Match the correct tape speed with the correct format

Standard Cassette	1 7/8 ips
Micro Cassette	15/16 ips

4.4.5 Explain the advantage of digital tape recordings over analog recordings.

4.4.6 Define the following terms:

- Dynamic Range
- Octave
- Impedance
- Noise
- Crosstalk
- Azimuth
- Signal-to-noise Ratio
- Attenuation
- Additive Noise
- Convolutional Noise
- Transfer Function
- Tonal Noise
- Frequency
- Decibel
- Analog
- Digital
- Wow and Flutter
- Ferric Oxide
- Analog to Digital Conversion
- White Noise
- Broadband Noise
- AC Hum
- Other terms may be added as necessary

4.4.7 Explain extraction of audio from video recordings

4.4.8 Explain the difference between balanced and unbalanced inputs.

4.4.9 Explain multi-directional, parabolic, and shotgun microphones.

4.4.10 What is the speed of sound in air at 21 degrees C/

4.4.11 What is the range of frequencies are typically analyzed in forensic audio processing? Why?

4.4.12 What is the dynamic range of analog tape?

4.4.13 Briefly explain each of the following filters/audio level controls:

- High pass
- Low pass
- Band pass
- Band stop Notch
- Slot
- Graphic Equalizer
- Parametric Equalizer
- Limiter
- Automatic gain Control
- Compressor/Expander
- Comb
- Spectral Inverse
- One Channel Adaptive

♦End